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(54) **PROBIOTIC BACTERIAL STRAINS PRODUCING ANTIMICROBIAL PROTEINS AND  
COMPOSITIONS COMPRISING THESE FOR USE IN THE TREATMENT OF CLOSTRIDIUM  
DIFFICILE INFECTION**

(57) The present invention is directed to a bacterial,  
preferably probiotic bacterial peptidoglycan hydrolase  
(PGH), a peptidoglycan hydrolase (PGH)-comprising  
bacterial, preferably probiotic bacterial strain or a pepti-  
doglycan hydrolase (PGH)-comprising composition for  
use in the therapeutic or prophylactic treatment of a bac-

terial infection, preferably for the treatment of a bacterial  
infection resulting in diarrhea. Further aspects of the  
present invention relate to corresponding methods for  
preparing a medicament and to a corresponding method  
of treatment.

**EP 4 295 902 A3**



## EUROPEAN SEARCH REPORT

Application Number

EP 23 20 5154

## DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2015/155244 A1 (LYSANDO AG [LI]) 15 October 2015 (2015-10-15) * page 1, lines 7-11 page 8, lines 1-4; claims 1-14 *	1-5	INV. A61K38/47 A61P1/12 A61P31/04
A	DE 196 49 096 A1 (BEIERSDORF AG [DE]) 28 May 1998 (1998-05-28) * page 3, lines 11-12; claims 1, 7 *	1-5	
A	DATABASE CAS [Online]  1 November 2006 (2006-11-01), Anonymous: "CAS:2006_1140995_912109478_1", XP093131419, Database accession no. 912109478 * abstract * & K. Makarova ET AL: "Comparative genomics of the lactic acid bacteria", Proceedings of the National Academy of Sciences, vol. 103, no. 42, 17 October 2006 (2006-10-17), pages 15611-15616, XP055004004, ISSN: 0027-8424, DOI: 10.1073/pnas.0607117103	1-5	TECHNICAL FIELDS SEARCHED (IPC)  A61K C12N A61P
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<del>The present search report has been drawn up for all claims</del>			
Place of search <b>Munich</b>		Date of completion of the search <b>15 February 2024</b>	Examiner <b>Habedanck, Robert</b>
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			



## EUROPEAN SEARCH REPORT

Application Number

EP 23 20 5154

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## DOCUMENTS CONSIDERED TO BE RELEVANT

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	<p><b>&amp; M. A. Azcarate-Peril ET AL: "Analysis of the Genome Sequence of Lactobacillus gasseri ATCC 33323 Reveals the Molecular Basis of an Autochthonous Intestinal Organism",</b> <b>Applied and Environmental Microbiology,</b> <b>vol. 74, no. 15,</b> <b>1 August 2008 (2008-08-01), pages</b> <b>4610-4625, XP055029769,</b> <b>ISSN: 0099-2240, DOI: 10.1128/AEM.00054-08</b></p> <p>-----</p> <p><b>US 2014/106435 A1 (KWACK IL YOUNG [KR] ET AL) 17 April 2014 (2014-04-17)</b> <b>* claim 1 *</b></p> <p>-----</p>	1-5	
			TECHNICAL FIELDS SEARCHED (IPC)
-The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		15 February 2024	Habedanck, Robert
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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EPO FORM 1503 03.82 (P04C01)



Application Number

EP 23 20 5154

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**CLAIMS INCURRING FEES**

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

**LACK OF UNITY OF INVENTION**

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

**see sheet B**

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

**1-5 (partially)**

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



# LACK OF UNITY OF INVENTION SHEET B

Application Number

EP 23 20 5154

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

## 1. claims: 1-5 (partially)

a peptidoglycan hydrolase for use in the treatment of a bacterial infection, wherein the peptidoglycan hydrolase is a polypeptide comprising an amino acid sequence of SEQ ID No. 89, nucleic acids encoding the same, recombinant vectors and host cells comprising the nucleic acid

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## 2-69. claims: 1-5 (partially)

same as invention 1 but wherein the peptidoglycan hydrolase comprises respectively an amino acid sequence from 90 to 151 and 158 to 163

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## 70. claims: 6-15 (partially)

A peptidoglycan hydrolase (PGH)-secreting probiotic bacterial strain that is *Lactococcus lactis*, for use in the therapeutic or prophylactic treatment of a bacterial infection, and compositions comprising the same

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## 71-84. claims: 6-15 (partially)

same as invention 70 but wherein the PGH-secreting probiotic bacterial strain is respectively *Lactobacillus gasseri*, *Lactobacillus crispatus*, *Lactobacillus jensenii*, *Lactobacillus plantarum* CCOS 893 (DSM 32352), *Lactobacillus fermentum*, *Lactobacillus johnsonii*, *Lactobacillus rhamnosus*, *Lactobacillus paracasei*, *Lactobacillus casei*, *Bifidobacterium animalis* subsp. *lactis*, *Bifidobacterium longum*, *Bifidobacterium breve*, *Bifidobacterium pseudocatenulatum* and *Bifidobacterium bifidum* (partially claims 6-15)

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# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 23 20 5154

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

15-02-2024

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